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(19) (CA) APPLICATION FOR CANADIAN PATENT (12)

(54) Snow-Plow System for Attachment to a Vehicle, Comprising a Reactive Constant Pressure Snow Plow Mechanism, a Quick Connecting/Disconnecting Snow Plow Apparatus, and a Lighting System

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(30) (US) 053,060 1993/04/26

(57) 10 Claims

Notice: This application is as filed and may therefore contain an incomplete specification.



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Abstract

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A snow-plow system having four major features: lighting system, a quick and easy disconnect/connect system, a reactive controlled pressure mechanism for applying a controlled pressure to the bottom edge of the moldboard of the plow, and a simple electric control to activate or deactivate the reactive controlled pressure mechanism. The present invention may be summarized as a snow-plow system that is mounted to a vehicle having a mounting frame by an easy connect and disconnect system connecting to the A-frame of the snow-plow by use of three mounting pins which hold the snow-plow system in place on the mounting frame of the vehicle and thereby rigidly connect the system to the vehicle. A light bar or lighting system also is rigidly mounted to the A-frame of the snow-plow at the mounting pins so that once the position of the lighting system is determined the relative position of the lighting system with respect to the vehicle does not change. A reactive controlled pressure mechanism that consists of a hydraulic control unit is operated by an electric control unit mounted in the vehicle. A reactive controlled pressure cylinder is pivotally mounted to the bottom of the A-frame and mechanically connected to the moldboard of the plow.

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A Snow-Plow System, for Attachment to a Vehicle, Comprising a  
Reactive Controlled Snow-Plow Mechanism, A Quick  
Connecting/Disconnecting Snow-Plow Apparatus,  
and A Lighting System

Background of the Invention

The present invention relates generally to the field of snow-plows and  
specifically to snow plows that are designed to be mounted to vehicles  
5 like a car or truck.

Snow-plows that are mounted to a vehicle, e.g. a snow-plow mounted to a  
pick up or sport utility truck, typically are designed so that much of the  
apparatus that is part of the snow-plow system is mounted directly and  
10 permanently to the vehicle. The equipment that remains upon the  
vehicle before the plow is mounted or after the plow has been removed  
forms a metal frame work on the front of the vehicle that increases the  
front end weight of the vehicle, affects the life of suspension components  
of the vehicle and affects the ride and steering characteristics of the  
15 vehicle.

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- The present invention is designed so that there is only a small mounting subframe located beneath the front bumper of the vehicle which is attached to the vehicle frame. All other components of the snow-plow system are mounted to this mounting subframe so that they can be easily and quickly removed from the vehicle. Consequently there is no substantial amount of mounting equipment covering the front end of the vehicle and little added weight permanently attached to the vehicle.
- 5
- 10 Also, the quick connecting/disconnecting structure of the present invention makes it very easy to attach or disengage the snow-plow system from the vehicle. This saves the operator of the vehicle both time and effort when installing and removing the snow-plow system.
- 15 Also, the present invention addresses the problem of light weight snow-plow moldboards. Typically snow-plow moldboards mounted to smaller vehicles (e.g. pick-up trucks) are of such a light weight that they do not effectively plow or cut through all types of snow. Hard, drifted, or icy snow such as that found in the Western United States is not easily
- 20 plowed by a light plow moldboard, e.g., a plow moldboard weighing 250 pounds or less. The present invention includes a reactive controlled pressure system that places a controlled predetermined pressure upon the moldboard of the plow system so that a portion of the weight of the vehicle to which the plow system is attached is actually transferred to
- 25 the bottom edge of the plow moldboard and the plow moldboard acts as a

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moldboard weighing 2 to 3 times its actual weight. This snow-plow system is thereby able to easily plow through snow that a light weight snow-plow normally could not plow through.

- 5 Further the invention provides the flexibility of having, in effect, both a light weight plow (which is advantageous for certain conditions such as plowing light snow on a gravel driveway) and a heavy weight plow (which is advantageous for plowing drifted and hard packed snow and for scraping hard surfaces). This flexibility is obtained by having a
- 10 reactive controlled pressure system which can be activated and deactivated by means of a simple electric control switch.

The controlled pressure mechanism maintains a pressure within a certain predetermined low pressure and high pressure limit with a predetermined nominal pressure within these limits.

15

- Further, the present invention addresses the problem of lights mounted to vehicles for plowing. Typically an additional set of headlights and parking lights are mounted to the front end of a vehicle for plowing. This is because the regular headlights and parking lights of the vehicle
- 20 are usually hidden behind the plow moldboard and thus are obstructed by the plow moldboard especially in the raised position. As such, the lights are rendered ineffective. Consequently it is has been the case that an additional set of lights are mounted either upon the hood or up on the front grill of the vehicle so that they project over the front edge of the plow
- 25 moldboard. The problem with this procedure is that those lights and

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their housings in and of themselves create obstructions in the driver's field of vision due to the fact that they are mounted on the vehicle. The device of the present invention moves these lights off of the vehicle and positions them so that they shine over the top edge of the moldboard  
5 while presenting a minimal obstruction to the field of vision of the driver or operator of the vehicle. The additional lights are removed when the snow-plow is removed (as the additional lights are not needed) so that they do not present any obstruction to vision or add any weight to the vehicle.

10

The inventor does not know of any prior art that either teaches or discloses the unique features of the present invention.

Summary of the Invention

15 The present invention is a snow-plow system having four major features: a lighting system, a quick and easy connect/disconnect system, a reactive controlled pressure mechanism for applying a controlled pressure to the bottom edge of the moldboard of the plow, and a simple electric control to activate or de-activate the reactive controlled  
20 pressure mechanism.

Accordingly, the present invention may be summarized as a snow-plow system that is mounted to a vehicle having a mounting means by an easy connect and disconnect system; the snow-plow system connecting to the  
25 mounting means by use of three mounting pins which hold the snow-

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plow system in place on the mounting means and thereby rigidly  
connect the system to the vehicle. A telescoping light bar or lighting  
system is also rigidly mounted to the mounting means so that once the  
position of the lighting system is determined the relative position of the  
5 lighting system with respect to the vehicle does not change.

Finally, the present invention also includes a reactive controlled  
pressure mechanism that consists of a hydraulic control unit that is  
operated by an electric control unit mounted in the vehicle. This  
10 controlled pressure mechanism can be activated and de-activated by an  
electric switch to provide the snow plowing action desirable for varied  
plowing conditions.

On larger municipal trucks, the hydraulic control unit of the reactive  
15 controlled pressure mechanism may be operated by the power take off  
(PTO) commonly found on larger trucks. The PTO, which is controlled  
mechanically from within the cab of the municipal truck, operates the  
hydraulic pump that supplies non-compressible fluid to the hydraulic  
cylinder of the reactive controlled pressure mechanism at a  
20 predetermined pressure.

There are three cylinders within the system. Two of the cylinders pivot  
the plow moldboard either left to right or right to left. This is standard  
on most snow-plows. Between the two cylinders and extending from the  
25 bottom of an A-frame is the reactive controlled pressure cylinder. The

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reactive controlled pressure cylinder is pivotally mounted to the bottom of the A-frame and mechanically connected to the moldboard of the plow.

The system with respect to the reactive constant pressure cylinder works  
5 as follows: Power is supplied to the system from the vehicle's electrical system. The operator of the vehicle turns on the system by activating a switch on the electrical control unit located within the vehicle cab. This activates a pressure switch on the hydraulic control unit that pressurizes the hydraulic cylinder to a predetermined pressure. The  
10 pressure causes the hydraulic cylinder to react against the frame of the vehicle and push against the moldboard so that the bottom edge of the moldboard that is in contact with the road surface has an optimal amount of pressure transferred to it. A transference of vehicle weight to the bottom edge of the moldboard of the plow is also achieved.

15 The hydraulic control unit functions by monitoring the pressure within the hydraulic cylinder so that should the pressure drop below a predetermined lower level, for example if the cylinder were to extend out as when the level of the road surface were to drop, a pressure switch  
20 would sense this drop and then supply more hydraulic fluid from the hydraulic fluid reservoir to re-pressurize the cylinder to its nominal predetermined pressure level. Conversely, if the plow moldboard bottom edge engages a surface that tends to raise the plow moldboard, this will result in increasing the pressure within the cylinder. Once that  
25 pressure meets or exceeds a predetermined high pressure level, a relief



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valve connected to the hydraulic fluid reservoir will open and hydraulic fluid from the cylinder will drain back into the reservoir until the pressure within the cylinder reaches the nominal pressure level. In this manner the system reacts to road conditions and snow conditions so that the controlled pressure is substantially constantly maintained.

Description of the Drawings

Figure 1 is a top plan view of the snow-plow system.

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Figure 2 is a side plan view of the snow-plow system.

Figure 3 is a schematic view showing the valve block and the main hydraulic or reactive constant pressure cylinder.

15 Figure 4 is a rear plan view of the lighting system.

Figure 5 is a schematic view of the electrical control circuit showing the circuit engaged in the blade down and float configuration.

20 Figure 6 is a schematic view of the electrical control circuit showing the circuit engaged in the pressure down configuration.

Figure 7A is a schematic view of the electrical control circuit showing the circuit engaged in the raise configuration.

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Figure 7B is a schematic view of the electrical control circuit showing the circuit engaged in the hold configuration.

Figure 8 is a schematic view showing the hydraulic control system in  
5 the blade float configuration.

Figure 9 is a schematic view showing the hydraulic control system in the pressure down configuration.

10 Figure 10 is a schematic view showing the hydraulic control system in the raise and hold position.

Figure 11 is side plan view of the vehicle subframe.

15 Detailed Description

Although the disclosure hereof is detailed and exact to enable those skilled in the art to practice the invention, the physical embodiments herein disclosed merely exemplify the invention which may be embodied  
20 in other specific structure. While the preferred embodiment has been described, the details may be changed without departing from the invention, which is defined by the claims.

The present invention is a snow-plow system 10 for mounting to a vehicle  
25 11. The main features of the snow-plow system 10 are a lighting system

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20, a mounting system 40, a reactive controlled pressure system 60, and an electronic control for engaging and disengaging the controlled pressure system 70. The snow-plow system 10 further includes a moldboard 100 and an A-frame 14 for supporting and connecting the components of the snow-plow system 10.

The snow-plow system 10 is connected to the frame of the vehicle 11 with mounting system 40. Referring to Figures 2 and 12 the snow-plow system 10 may be seen to be connected to the vehicle 11 by a mounting subframe 12 that is fixedly connected to the frame of the vehicle 11.

The mounting system 40 is integral to the A-frame 14 as shown in Figure 1. The subframe 12 has mounting points 16-18 having openings 50-52 as shown in Figure 11. The mounting system 40 has three mounting points 41-43, having openings 44-46, and three mounting pins 47-49. Mounting points 16-18 of the subframe 12 correspond to mounting points 41-43 of the mounting system 40 so that openings 50-52 align respectively with openings 44-46. Pins 47-49 pass through the aligned openings 50-52 and 44-46. Locking pins 53-55 are respectively used to hold the pins 41-43 in place in the openings 50-52 and 44-46 during operation of the vehicle 11. In this manner the snow-plow system 10 of the present invention is quickly and easily mounted to the vehicle 11 so that there is a rigid and fixed connection between the vehicle 11 and the snow-plow system 10 through the mounting subframe 12 which is attached to the frame of the vehicle 11.

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Referring now to Figures 1, 2, and 4 the lighting system 20 may be seen to comprise a set of high intensity light road lights 22 mounted to a support frame 24. Any type of lights 22 providing sufficient illumination could be used. The lights 22 are powered from the vehicle 11 in a known manner. The support frame 24 has two mounting points 25-26 having openings 28-29. As specifically shown in Figures 1 and 2 the mounting points 25-26 line up with the mounting points 41 and 42 of the mounting system 40. Accordingly, the support frame 24 is fixedly and rigidly mounted to the subframe 12 by the same mounting system 40 as is the rest of the snow-plow system 10 by the pins 47 and 48 of the mounting system 40. In this manner the lighting system 20 is rigidly and fixedly mounted to the vehicle 11 with the lights 22 positioned to shine over the top edge 102 of the moldboard 100 and at the same time being set off from the body of the vehicle 11 to minimize any obstructions to the vehicle operator's field of vision.

Further, referring specifically to Figure 2, the support frame 24 may be seen to include two posts 36 that are telescopically adjustable to move the lights 22 vertically up or down with respect to the plow system 10. A plurality of openings 37 extend up and down the sides of the posts 36. Once the proper height for the lights 22 has been determined the openings 37 in the telescoping posts 36 are aligned with openings 39 in support frame 24 and bolts 38 are passed through the openings 37 and 39. Each bolt 38 is secured by using a nut. This holds the lights 22 in the vertical position desired. Accordingly, the lighting system 20 of the

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present invention may be easily adjusted to the needs of the individual vehicle operator and in order to obtain maximum illumination of the area in front of the vehicle regardless of the snow-plow's position.

- 5 Referring to Figures 1-3 and 5-10 the reactive controlled pressure system 60 may be seen to comprise an electrical control unit 70, a hydraulic control unit 80, and a hydraulic cylinder linkage 90. As can be seen in Figure 2, hydraulic cylinder linkage 90 includes a bell crank 95 to aid in the effective transference of weight or force from the mass of the vehicle
- 10 11 to the bottom edge 101 of the moldboard 100. While a bell crank 95 is the means of mechanical linkage disclosed, it is not the only possible means for accomplishing the same function.

The electrical control unit 70 is shown schematically in Figures 5-7B.

- 15 The electrical control unit 70 operates off the battery power of the vehicle 11 and is energized when the vehicle ignition key is turned to the accessory setting or when the engine of the vehicle 11 is running. The electrical control wiring harness 65 includes a plug 66 and a receptacle 67 that can be separated when the snow-plowing system 10 is removed
- 20 from vehicle 11. As shown in Figures 5-7B, the electrical control unit 70 has two switches 61 and 62 that control the hydraulic lift and reactive pressure control unit 80.

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1 The hydraulic control unit 80 is connected to the reactive controlled  
pressure mechanism or hydraulic cylinder 91 by hoses 81 and 82. The  
hydraulic control unit 80 supplies non-compressible fluid, hydraulic oil,  
to the cylinder 91. Hydraulic cylinder linkage 90, a bell crank, is  
5 connected to hydraulic cylinder 91.

The reactive constant pressure system works as follows:

To raise the plow moldboard 100 the operator actuates switch 61 as  
shown in Figure 7A to the up position. Now referring to Figure 10, the  
10 four way valve 110 and the two way valve 111 are de-energized. When the  
switch 61 energizes the pump 112, valve 111 blocks the flow to the  
reservoir 120. This causes the oil to flow into valve 110 from port 3 and  
out of valve 110 through port 2 into the rod end 92 of the cylinder 91. This  
lifts the plow moldboard 100. The opposite end of the cylinder 91 is open  
15 to the reservoir 120 through ports 4 to 1. When the cylinder 91 is  
completely extended the pump 112 is turned off by releasing the control  
switch 61.

To hold the plow moldboard 100 in a raised position for transport, the  
20 switch 61 is held in a neutral position and the switch 62 can be in either  
position as shown in Figure 7B. This position de-energizes the pump 112  
and the valves 110 and 111. Valve 111 blocks all flow to the reservoir so  
that the raised position of the plow is maintained. See Figure 10.

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To float the plow moldboard 100 so that it is in the down position but has no down pressure on it, the control switch 61 is depressed to the down position and control switch 62 is depressed to the float position. See Figure 5. Referring to Figure 8, this energizes valve 111 and de-  
5 energizes valve 110. Energizing valve 111 opens the rod end 92 of the cylinder 91 to the reservoir 120. Thus both ends of the cylinder 91 are connected to the reservoir 120 and the moldboard 100 will float.

To apply a predetermined down pressure to the plow moldboard 100, the  
10 control switch 61 is depressed to the down position and control switch 62 is depressed to the pressure position as shown in Figure 6. This energizes the four way valve 110 and connects a pressure switch 121 to the pump activating circuit as shown in Figure 9. Energizing valve 110 reverses the flow of oil from the pump 112 to the opposite end 93 of the  
15 cylinder 91 putting a predetermined amount of pressure upon the bottom edge 101 of the plow moldboard 100.

When the pressure on the piston 94 of the hydraulic cylinder 91 reaches the predetermined pressure that has been set, the pressure switch 121  
20 activates and opens the circuit stopping the pump 112. The check valve 130 in the line prior to valve 110 retains the oil in the piston 94 so that there is a controlled predetermined pressure maintained on the bottom edge 101 of the moldboard 100.

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If the bottom edge 101 of the moldboard 100 rises, e.g. due to a change in road surface, sufficient to increase the pressure within the cylinder 91 beyond a predetermined high pressure setting, then the relief valve 122 opens and oil is allowed to flow back into the reservoir 120 until the  
5 pressure in the cylinder 91 drops down to below the predetermined high pressure setting.

Once the situation causing the high pressure abates, the pressure can  
10 drop down to a predetermined low pressure setting when the bottom edge 101 of the moldboard returns to a normal plowing position. At this predetermined low pressure the pressure switch 121 again activates the pump 112 and oil is pumped from the reservoir 120 into the cylinder 91 until the predetermined nominal pressure is again reached.

15 It should be noted that it is not necessary for there to be a pressure increase before there is a pressure drop. If the plow moldboard 100 drops into a depression on the surface being plowed, the oil pressure in the cylinder 91 could drop below the predetermined minimum setting.  
20 This drop would also be sensed by the pressure switch 121 and cause activation of the pump 112 to increase the pressure in the cylinder 91 back up the predetermined nominal pressure setting.

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Furthermore, it should be noted that the plow moldboard 100 can be raised without releasing control switch 62 from the pressure position.

By merely depressing control switch 61 to the up position, the plow moldboard 100 is lifted without disengaging the down pressure system. When the moldboard 100 is subsequently lowered, the predetermined downward pressure is again applied to the bottom edge 101 of the plow moldboard 100.

In its specific embodiment the pressure differential is set so that the difference between the highest internal pressure in the cylinder 91 and the lowest internal pressure will allow the plow moldboard 100 to follow the surface contour of the road over small variations without activating the pump 112 or relief valve 122 and yet react to maintain a nearly constantly controlled pressure upon the bottom edge 101 of the plow moldboard 100.

In the preferred embodiment, the nominal pressure setting is 500 psi, the low pressure setting is 450 psi, and the high pressure setting is 600 psi. It is to be understood, however, that different pressure settings can be used to obtain the optimum weight transfer if this system is used with heavier or lighter weight snow-plows or if the geometry of the lift mechanism is changed.

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The above described embodiments of this invention are merely  
descriptive of its principles and are not to be limited. The scope of this  
invention instead shall be determined from the scope of the following  
5 claims, including their equivalents.

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THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

- 1 1. A reactive controlled pressure snow plow system for use with a  
2 snow-plow, having a moldboard, for mounting to a vehicle, the reactive  
3 controlled pressure snow-plow system comprising:  
4 a reactive controlled pressure mechanism mechanically  
5 connected to the vehicle and to the moldboard of the snow-plow;  
6 a reactive controlled pressure system for controlling the reactive  
7 controlled pressure mechanism by supplying and removing a non-  
8 compressible fluid from the reactive controlled control mechanism in  
9 response to changes exceeding a predetermined pressure range within  
10 the reactive controlled pressure mechanism; and  
11 the reactive controlled pressure system being connected to the  
12 reactive controlled pressure mechanism.
- 1 2. A quick mount system for mounting a snow-plow to a vehicle, the  
2 quick mounting system comprising:  
3 a support means for supporting the snow-plow, the support  
4 means having at least three mounting points;  
5 a frame having at least three mounting points;  
6 a connecting means for connecting the mounting points of the  
7 frame to the mounting points of the support means;  
8 the mounting points of the frame being connected to the mounting  
9 points of the support means by the connecting means; and  
10 the support means being connected to the vehicle and the frame  
11 being connected to the snow-plow.

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1 3. The mounting system of claim 2 further including a lighting  
2 system for use with a snow-plow, having a moldboard, designed to be  
3 mounted to a vehicle, the lighting system comprising:  
4 at least one light connected to a support frame;  
5 a subframe connected to the vehicle;  
6 a connecting means for rigidly connecting the support frame to  
7 the subframe; and  
8 the support frame being connected to the subframe by the  
9 connecting means.

1 4. A lighting system for use with a snow-plow, having a moldboard,  
2 designed to be mounted to a vehicle, the lighting system comprising:  
3 at least one light connected to a support frame;  
4 a subframe connected to the vehicle;  
5 a connecting means for rigidly connecting the support frame to  
6 the subframe; and  
7 the support frame being connected to the subframe by the  
8 connecting means.

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1 5. The reactive controlled pressure snow plow system for use with a  
2 snow-plow, having a moldboard, for mounting to a vehicle of claim 1  
3 further including a lighting system for use with the snow-plow, having  
4 a moldboard, designed to be mounted to a vehicle, the lighting system  
5 comprising:  
6 at least one light connected to a support frame;  
7 a subframe connected to the vehicle;  
8 a connecting means for rigidly connecting the support frame to  
9 the subframe; and  
10 the support frame being connected to the subframe by the  
11 connecting means.

1 6. The reactive controlled pressure snow plow system for use with a  
2 snow-plow, having a moldboard, for mounting to a vehicle of claim 1  
3 further including a quick mount system for mounting the snow-plow to  
4 a vehicle, the quick mounting system comprising:  
5 a support means for supporting the snow-plow, the support  
6 means having at least three mounting points;  
7 a frame having at least three mounting points;  
8 a connecting means for connecting the mounting points of the  
9 frame to the mounting points of the support means;  
10 the mounting points of the frame being connected to the mounting  
11 points of the support means by the connecting means; and  
12 the support means being connected to the vehicle and the frame  
13 being connected to the snow-plow.

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- 1 7. The reactive controlled pressure snow plow system for use with a  
2 snow-plow, having a moldboard, for mounting to a vehicle of claim 6  
3 further including a lighting system for connecting to the snow-plow,  
4 having a moldboard, designed to be mounted to a vehicle, the lighting  
5 system comprising:  
6 at least one light connected to a support frame;  
7 a subframe connected to the vehicle;  
8 a connecting means for rigidly connecting the support frame to  
9 the subframe; and  
10 the support frame being connected to the subframe by the  
11 connecting means.

- 1 8. The reactive controlled pressure snow-plow system of claim 1  
2 which can be activated or de-activated by an electric control switch.

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1 9. A lighting system for use with a snow-plow, having a moldboard,  
2 designed to be mounted to a vehicle, the lighting system comprising:  
3 at least one light connected to a telescopically adjustable support  
4 frame;  
5 a subframe connected to the vehicle;  
6 a connecting means for rigidly connecting the suport frame to the  
7 subframe; and  
8 the support frame being connected to the subframe by the  
9 connecting means.

1 10. The reactive controlled pressure snow-plow system of claim 8  
2 which allows the snow-plow to be raised without electrically de-  
3 activating the reactive pressure control system.

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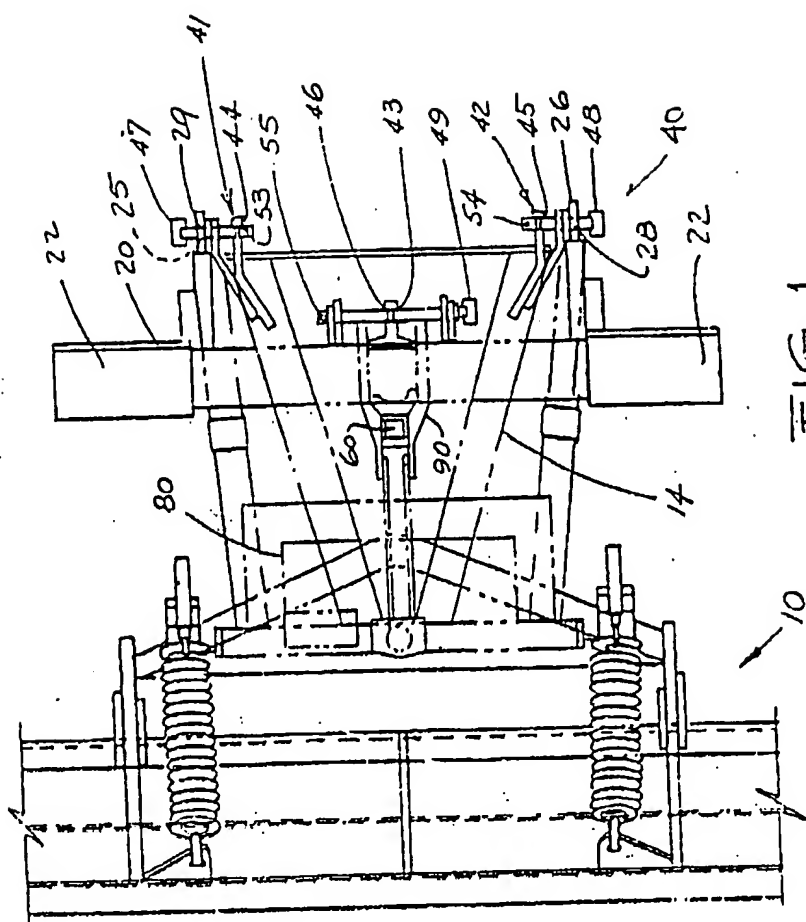


FIG. 1

PERKINS & WILSON  
PATENT, 1911



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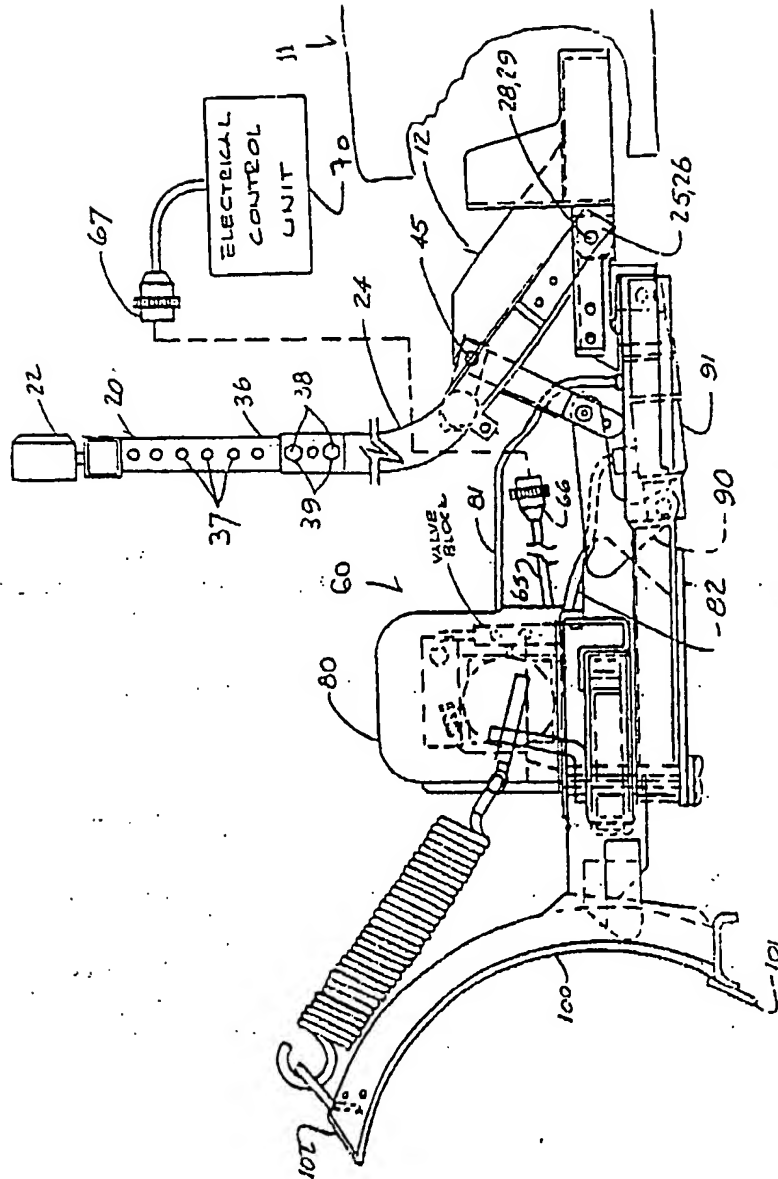


FIG. 2

PERLEY ROBERTSON  
PATENT, 1944

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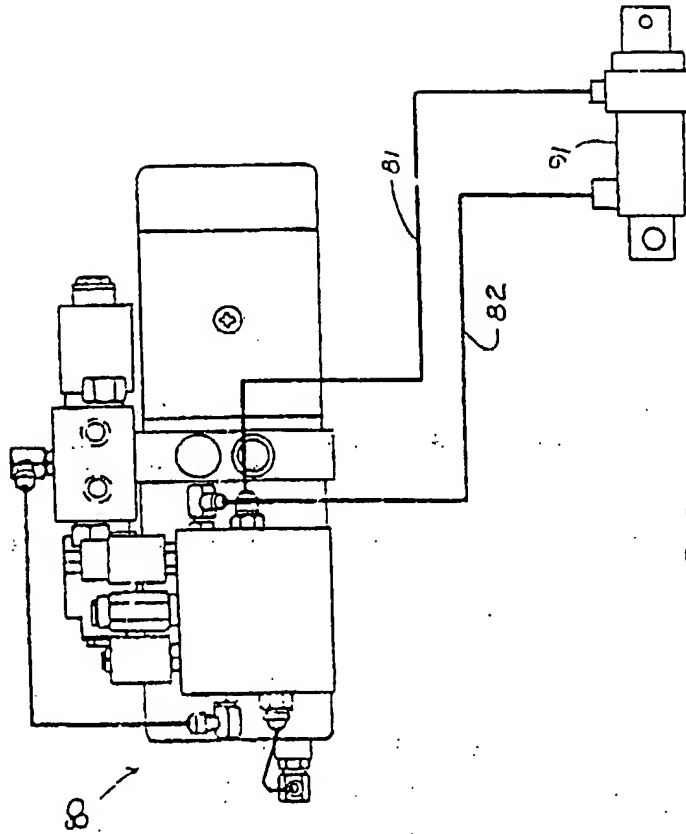


FIG. 3

PERLEY-ROBERTSON  
PATENT, 1914, 2, 12, 1914  
PATENT AGENTS

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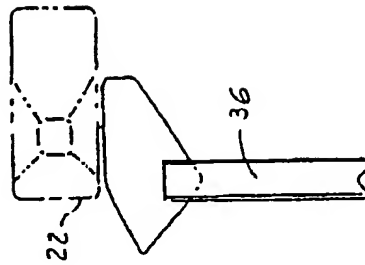
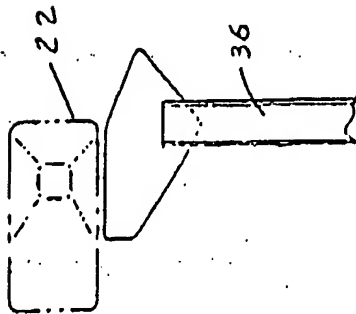


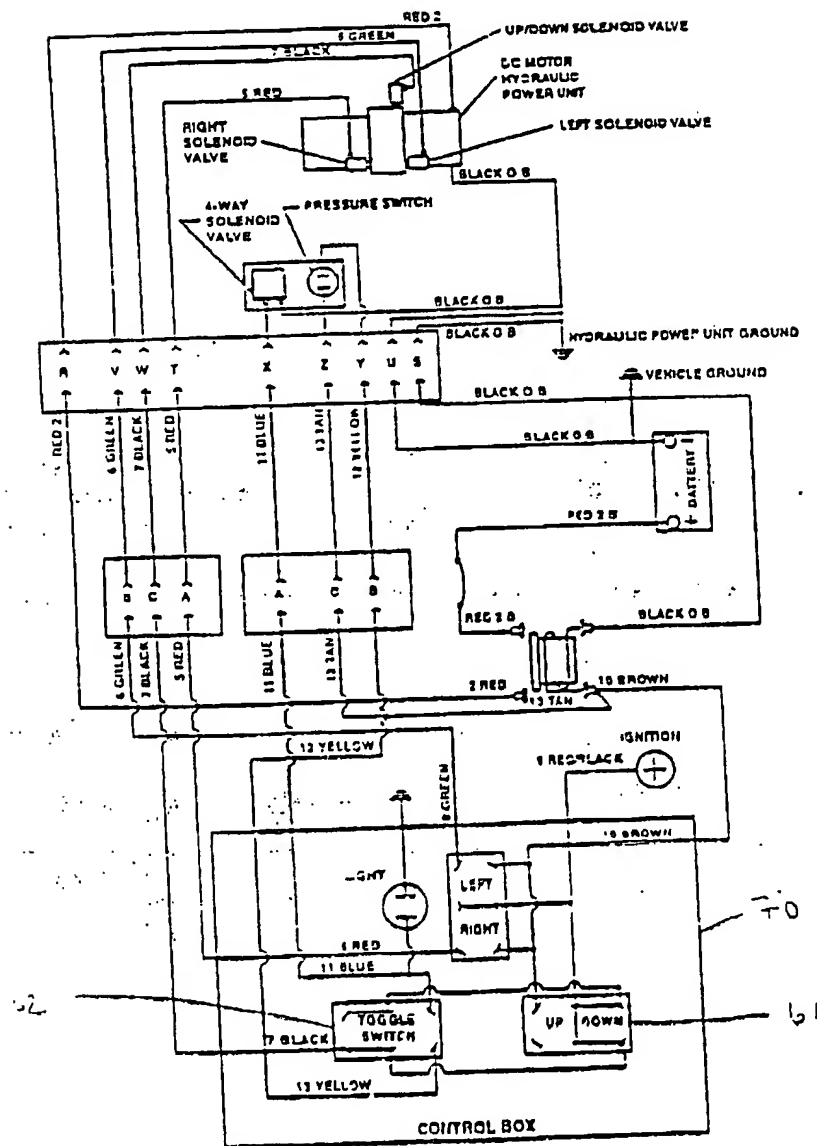
FIG. 4



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PATENT, TRADE MARK & DESIGN  
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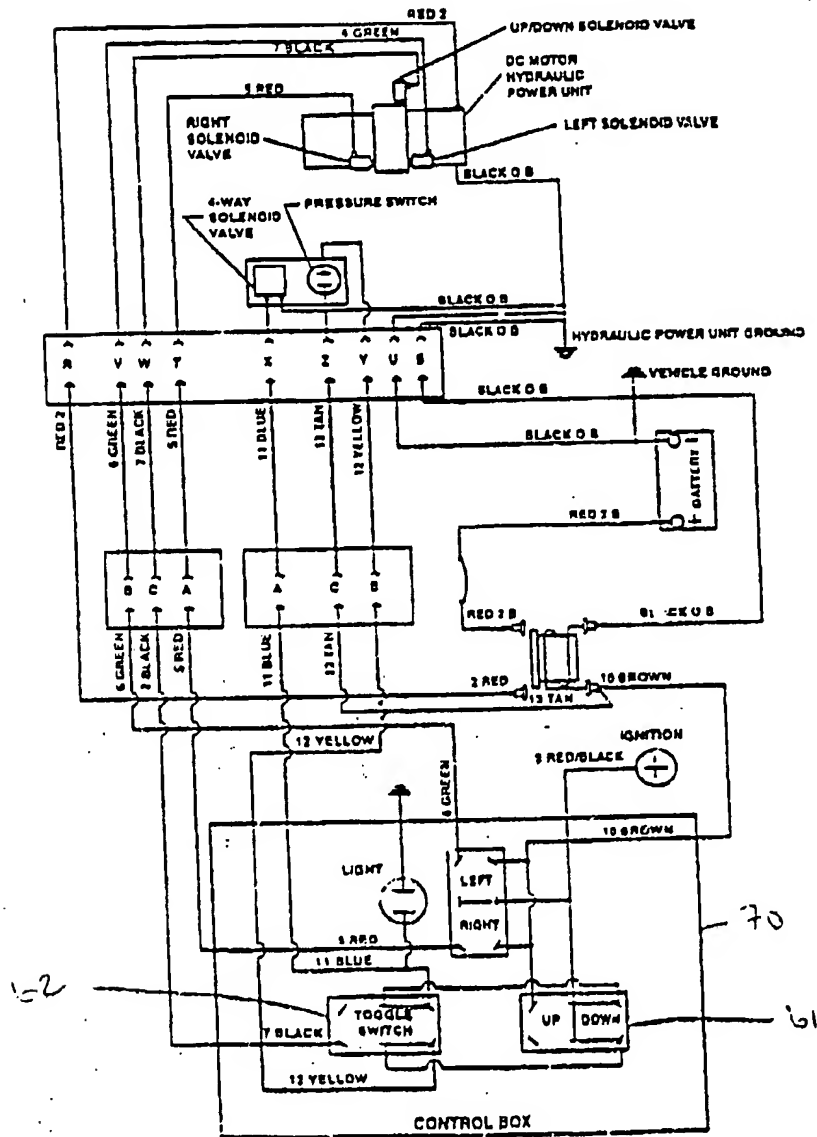
FIG. 5 : WIRING SCHEMATIC



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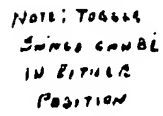
FIG 6: WIRING SCHEMATIC



PERLEY-ROBERTSON  
PANEY, INC. & ASSOCIATES  
P.O. BOX 1015



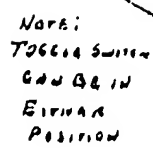
FIG. 7A



PERLEY-McKENNA  
FABRY, 1901 & 1902  
PATENT RIGHTS

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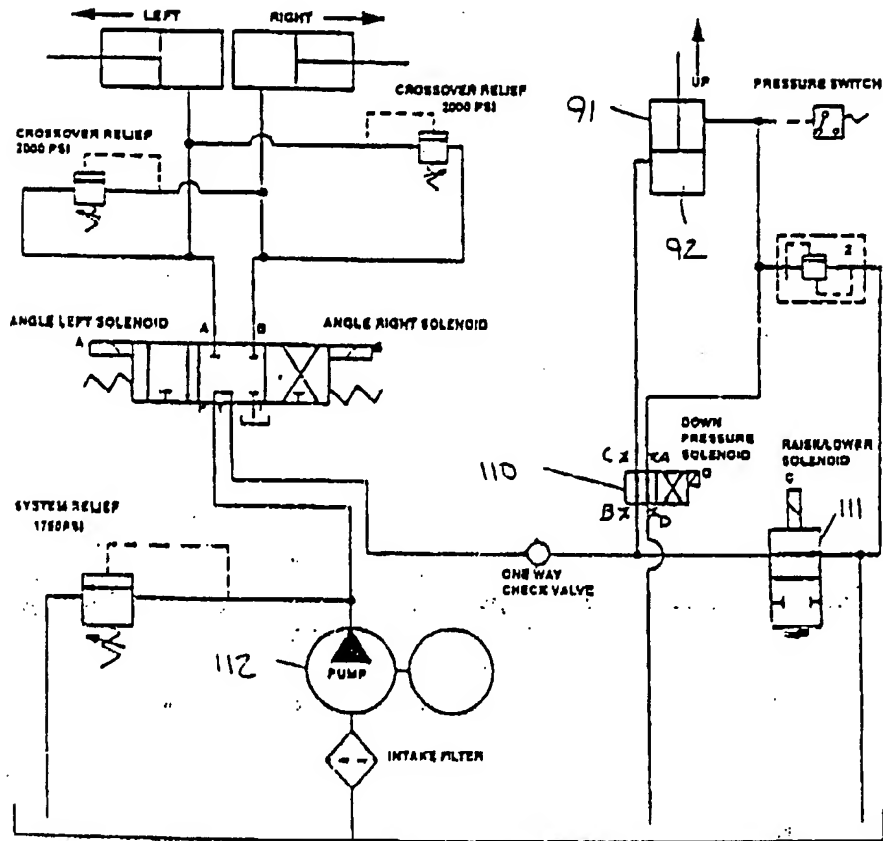
FIG. 7B: WIRING SCHEMATIC



PERLEY MAC. BRIDGES  
FARLEY, R. L. BRIDGES  
PATENT AGENTS

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FIG. 8: HYDRAULIC SYSTEM SCHEMATIC

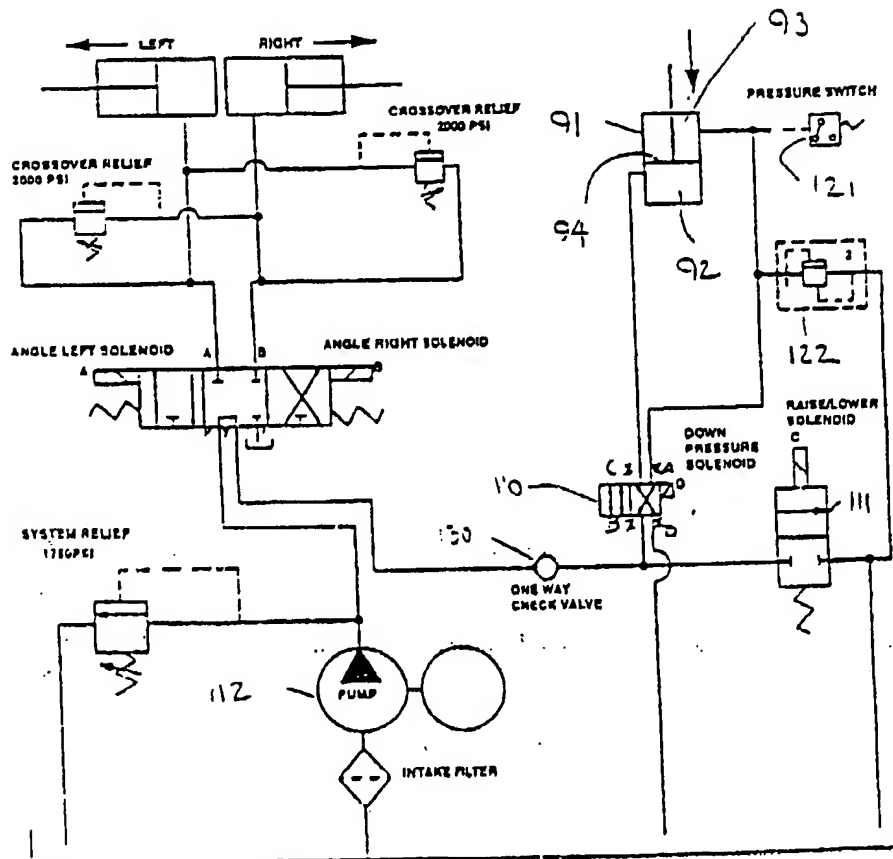


PERCEY COMPANY  
PACIFIC DIVISION



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FIG 9 : HYDRAULIC SYSTEM SCHEMATIC

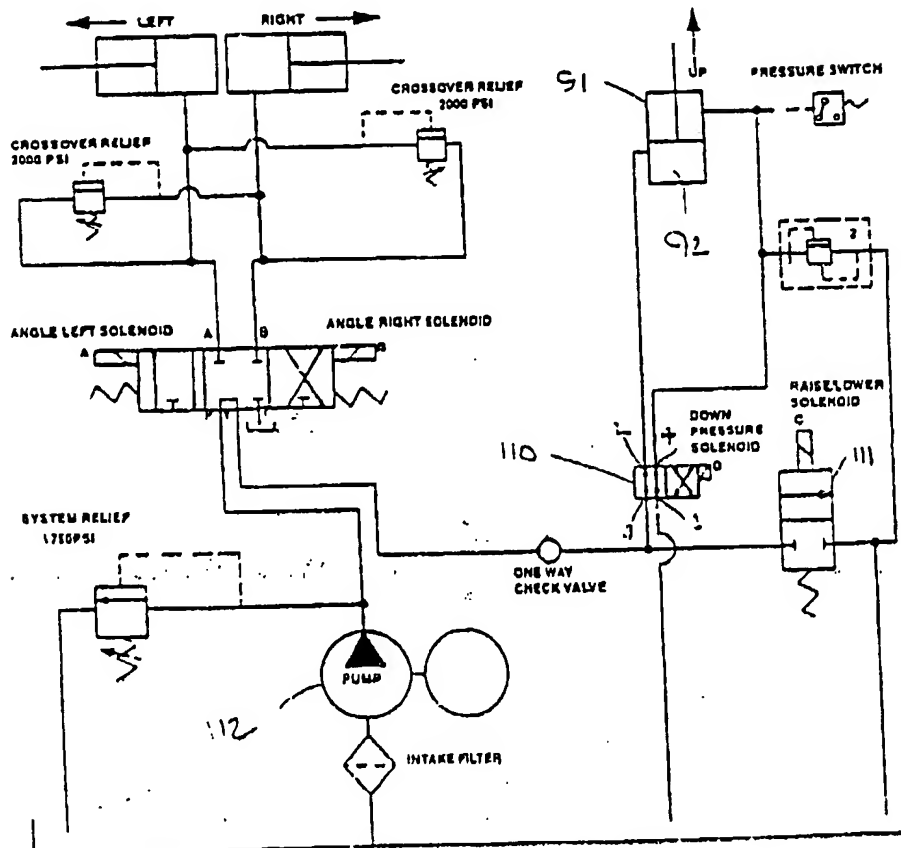


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FIG 9 :  
HYDRAULIC SYSTEM SCHEMATIC

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FIG 10: HYDRAULIC SYSTEM SCHEMATIC



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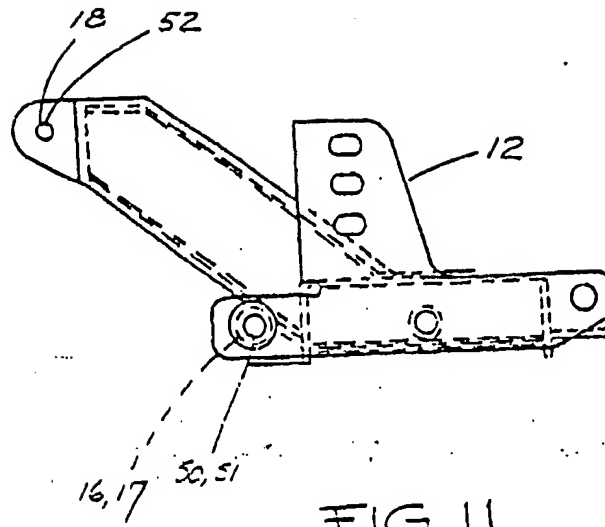


FIG. 11

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